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## POULTRY INDUSTRY AND THE SUSTAINABLE DEVELOPMENT OF TERRITORIES: WHAT LINKS? WHAT CONDITIONS?

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**Abstract** — The relations between poultry industry and territories are specific in agriculture. Several reasons can be given: modern poultry farms are considered as off-land, poultry productive chain is driven by major industrial operator, and relocating the production is easy. For a better understanding of the sustainability of agricultural territories, it can be helpful to characterize some interactions between the production chain and the territories. For that, two contrasted countries, France and Brazil were chosen and within each, one territory with significant poultry production are considered. The “poultry production \* territory” systems were studied and compared through a systemic approach. From this analysis, common features were obtained but also contrasted ones explaining, at least partially, the observed dynamics: positive in Brazil, less optimistic in France. However, sustainability should not be reduced to the economical growth and the other axis underlined that the double-sided impacts could also be found on the social or the environmental areas. A DPSIR model was used to understand and describe the changes in each system. As a main output, this work examines how the “poultry production \* territory” system took place and evolved in each case, and discusses the main factors to evaluate sustainability resulting from the interaction between poultry production chain and territories.

**Key words:** Sustainability, poultry industry, poultry farms, territory, Brazil, France

**Résumé** — Les relations entre aviculture et territoire sont uniques en agriculture. Plusieurs raisons peuvent être données : les productions avicoles modernes sont considérées comme hors-sol, la filière est conduite par un opérateur industriel principal, et la production est facilement délocalisable. Pour caractériser la durabilité des bassins de production nous nous sommes intéressés aux interactions entre la filière et le territoire. Pour cela, deux situations contrastées ont été étudiées, la France et le Brésil. Ce travail discute les principaux facteurs d'évaluation de la durabilité résultant de l'interaction entre filière avicole et territoire.

**Mots clés** : Durabilité, industrie avicole, aviculteur, territoire, Brésil, France

### INTRODUCTION

Poultry production chain is generally considered as a highly technically evolved animal production system. It is an integrated sector with different specialised tasks devoted to qualified workers, among them the farmers. Poultry production chain is often seen as “offland”. However, three aspects could jeopardize this standpoint: the production of feedstuffs needs land, the manure from the poultry shed will be spread on fields, and the poultry chain as a local industry is a source both of employment and of positive or negative

externalities. So, to deal with poultry production chain sustainability, one way seems to identify and explore the links between poultry industry and territory. Therefore, we considered here two contrasted territories, in France and Brazil, two countries in which obvious economical differences have been stressed. In France, Brittany region is faced with stable or decreasing production, while in Rio Verde, in the state of Goias, Brazil, the poultry sector has grown rapidly. In each area, we tried to describe the over-all relations between the poultry production chain and the territory, in view to understand and articulate the processes driving a given “poultry production system \* territory” aggregate.

## **1. METHODS**

Sustainability of the system “poultry production \* territory” could be studied in different steps. First of all, a classical supply chain analysis is performed. The actors are identified from the breeding steps up to the transforming firms (delivering ready-to-sell products). Their functions are defined: feeds or birds supply, poultry breeding, technical support, slaughtering, cutting and processing... The links between the actors are characterized through the involved fluxes (birds, feeds, money, information ...). Our approach is quite similar to that of Bokkers and de Boer (2009). Since our hypothesis is that the time evolution is a key factor to understand the system dynamics, the three above categories are described over a time frame depending on the observed territory (from a 20 years for Rio Verde to 60 years for Brittany). For the data collection, a similar approach was used over these territories. On one side, statistical data were obtained from the state or professional figures. On the other side, actors at different levels of the production chain and from local governing bodies were interviewed conscientiously. However due to the very high economical competition on the poultry markets, the obtained pieces of information were combined to preserve the required confidentiality.

The second step is to describe how the elements of the poultry chain are located, and to quantify the fluxes between them over a given territory. This includes the location of the plants, such as feed mills, hatcheries, slaughterhouses... the farms and roads density, the jobs directly or indirectly involved in the supply chain, and other interacting actors as the financing or governing bodies. It is important to keep in mind that part of the actors of the system are not located within the specified territory; whatever the poultry chain, soybean comes from Brazil or Argentina; because of the very few poultry breeding companies, many territories are devoid of. This approach results in a characterization of the system “poultry production chain \* territory” as an industrial cluster, with a given level of development; it can be a young, a mature, or a decreasing one. The borders of such a system are not automatically given.

On the third step we used the DPSIR model (Driving forces, Pressures, State, Impacts and Responses), a methodology initially proposed by OECD (EEA, 1999; Costantino et al, 2004), in order to value the previous representations, pieces of information collected through actors' interviews and statistical collection. First of all, driving forces of the system are identified. They could be either internal (e.g.: financing policies) or external (e.g.: market demand). They can have contrasted impacts on the system dynamics. Secondly pressures are acting on the system, either internally exerted (e.g.: power relationships between actors) or externally (e.g.: citizen pressure on the environmental or welfare issues). These parameters define the area in which the system could evolve towards a dynamic sustainability. Thirdly, a few parameters can define the present state of the “poultry production chain \* territory” system, both with static (e.g.: figures describing the employment or the production size) or dynamic (e.g.: numbers of farms changes over a given time frame) values. Fourthly, the combined effects of the two previous sets on the third one give the impacts of the systems dynamics on the sustainability criteria. And finally, it is possible to identify how the system tries to respond in view to remain efficient and evolving.

From these DPSIR and the exchanges with the stakeholders, conditions for sustainability could be proposed with some associated criteria.

## **2. SUSTAINABILITY**

The “poultry production chain\* territory” system has to deal simultaneously with the three pillars of sustainability: economical, social and environmental ones. We have also to consider three main principles related to sustainability: solidarity between human generations and between territories, precautionary principle to avoid any “non going back” action which could hinder the dynamics of the system, and the social will of participation.

The hypothesis is that sustainability of the system “poultry production chain \* territory” should be considered both spatially and temporally. Therefore this leads us to focus on the trajectory of the system, and allows us to discuss its possible evolution. We try consequently to explain the main characteristics of the poultry sector and their links with the territory over time and spatial frames to evaluate the studied system’s dynamics.

For the economical aspects, until now the system is strongly focused on evaluating and reducing the poultry production costs, expressed per kg live weight or kg carcass weight. Expressing in two units underlines a key struggle encountered in the poultry production chain, i.e. how to share the economical value of the production between the territory (here mostly the farmers and the employees in the plants) and the poultry chain (from the feed mills to the volume retailing). The main reason for this kill-cost behaviour is obviously the need of competitiveness on the market. Brazil and France (through EU) are more or less in front competition for the same markets even though niche markets are somewhere hiding the main standard volume issue. So, first of all, sustainability requires remaining in the market.

For the environmental issues, depending on the available pieces of information, it could be possible to characterize specific impacts on the territory, for instance on water quality or on land use. However, it was necessary to evaluate which part of the measured environmental impacts on the territory can be linked strictly to the poultry production chain, leading us to consider the other animal productions’ environmental impacts. Symmetrically, the environmental impact of poultry chain from one territory on other ones was also questioned through the feedstuffs supply and the animal terrestrial or at sea transportations. As an example, French counties got most of the soybean required for a consistent poultry growth from Brazil. Another point was the compliance with the local regulations for environment, particularly for water purification, or for manure spreading areas. These regulatory issues could be considered as constraints therefore decreasing the poultry chain economical competitiveness on a short time scale, while they could be taken as driving forces to reach more ecological intensive production system through land production potential conservation.

For the social pillar, several stakeholders’ points of view were considered. Firstly, the combination of the poultry farms and their very close community is studied to evaluate the dynamics of farms renewal on the long term impact on the sustainability of the poultry potential production chain within the territory. The key actors are the farmers and their families, who are only a tiny piece of the overall system but their decreasing number will lead to a collapse of the traditional family based poultry production system. A second social axis is the local interaction of the poultry chain with the society over the territory; if there are common implications of the poultry chain’s actors and the citizens over the territory, this could strengthen the bonds between the poultry chain and the land and therefore improve the system resilience to external constraints. Two examples could be given: local cultural identities around a very specific poultry product, large employment thanks to the local firms from the poultry chain. A third standpoint is through the governing bodies, both from the poultry chain and the county; their relations and interactions may be contrasted from a case to another, strongly influencing the sustainability of the defined local system. Poultry chain relocations are mainly connected with economical issues; however they could be balanced by state or local institutions through money supply but also provided services or available infrastructures proposed by the local community.

Sustainability includes a compulsory solidarity between human generations. It is possible to state that poultry industry offers a very critical case: biological cycles which allow the industrial organization of the chain are very brief, so that the usual time unit used by the actors is the week. Simultaneously, each actor has to consider the time for his investments

returns, i.e. at least ten years. Moreover, this long time must be taken into account for the poultry system as whole, due to the very close relations between its different links. According to Godard (2001), from a general stand point, present generations raise three types of means to ensure the future ones a nice time: industrial mean (confidence in technology and innovation), merchantable mean (through the contracts, within and between the generations), or patrimonial mean (through attachment to identity or cultural values). Each of these means can be seen in poultry chain, more or less present, depending on the actors and the territories.

Sustainability requires avoiding any irreversibility. Two problems may be pointed. It's now well established that diversity is a very positive effector for adaptative capacities; but diversity is seldom encountered within the poultry chains: animal strains, technical packages for a batch of poultry, birds sheds, contract between actors, etc... are often similar whatever the "poultry chain \* territory" system. Another question is how and where irreversibilities can be generated, what are the "non going back actions"? Several paths could be proposed: cumulative effects of increasing animal density over various territories, resulting into negative environmental impacts, decreasing number of farmers or production potential down to values disqualifying the territory as a production zone, increasing impact of the local or national society leading to a "not in my backyard" behaviour, as it might be illustrated in the EU through some "lobby-driven" regulations.

Lastly, in poultry production chains, a leading actor, often a manufacturer, concentrates a number of functions, playing as an organizer and a planner, defining the technical packages for poultry farmers. Some actors could also be alone within a given territory but acting in several ones. Therefore, many decisions regarding the whole chain, eventually over several territories, are taken by a very close and limited circle of persons, in a typically top-down process. This very usual situation weakens clearly the bonds between the poultry chain and the whole society living on the territory, since the governing actors are integrating pieces of information that together could infer negative choices for a given territory whereas it could be positive for another one. The typical example is the relocation of poultry production between territories, with the direct and indirect employment attached to these decisions.

### **3. THE "POULTRY PRODUCTION CHAIN \* TERRITORY" SYSTEMS**

We want to explain briefly how "poultry production chain \* territory" system takes place and how it changes over the time. The two cases are shown: Brittany for France, Rio Verde for Brazil. The DPSIR model for Brittany is in figure 1, the one for Rio Verde in figure 2.

#### **3.1. Brittany**

Brittany is the first region of France for animal production, giving in 2008 21% of the total milk, 10% of beef, 25 % of calf, 57% of pork, 34% of poultry meat and 42% of eggs, over 1658000 ha devoted to agriculture, representing 5.6% of the total national useable farm area. Agriculture in Brittany appears immediately heavily productive, and involved in various strong food chains. The region also has a consistent production of early and field vegetables. As a consequence, agriculture provides close to 6% of the total regional employment, while agriculture and agrofood sector represent 8% of the total regional GDP in 2008. Poultry production takes place mainly in the western part of the region, Finistère, Côtes d'Armor and Morbihan departments.

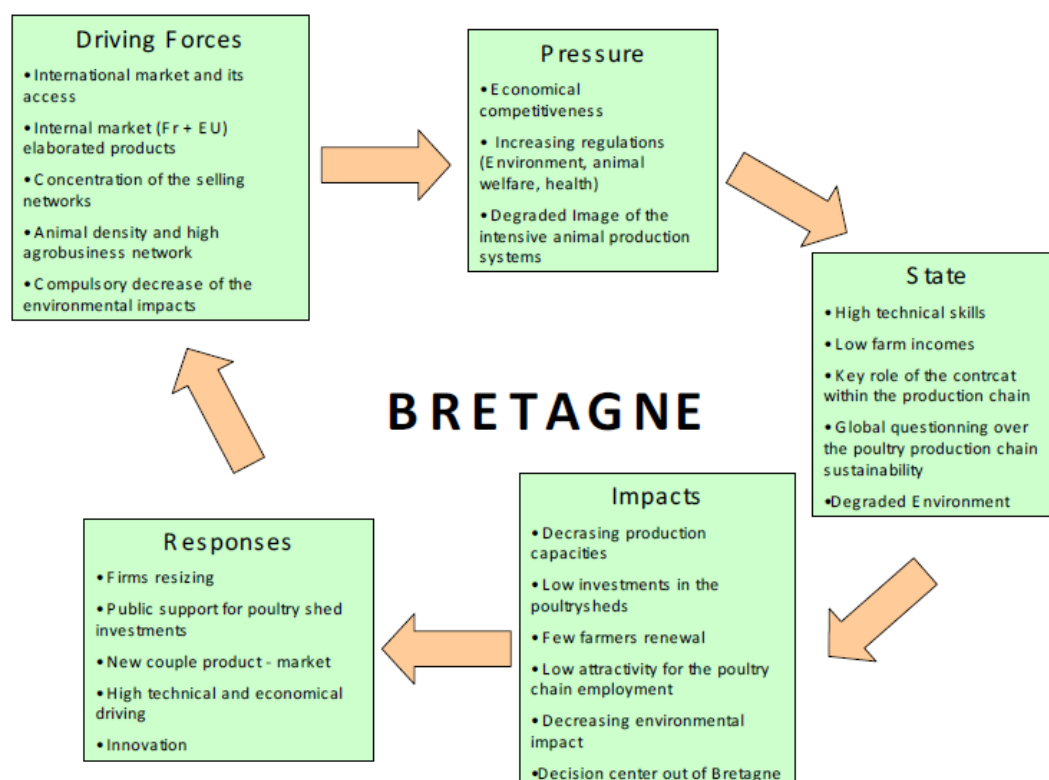
Poultry industry rose in Brittany after the 2<sup>d</sup> world war. The region had then very small farms, and poultry production gave peasants a way to increase their income. During the 60's, industrial groups developed in the region, either private (Doux, Tilly...) or cooperative (UNICOPA...) Within a few years, main elements of a complete poultry chain took place in Brittany: hatcheries, feed mills, slaughterhouses... Small farms in search of better incomes and entrepreneurs both were clearly the key actors of the early development of poultry production in Brittany. A few years after, export subsidies provided by the young common agricultural policy (CAP) helped the development of a large production of chicken specifically

devoted to the world market (Middle East countries). Brittany became rapidly the major French region for poultry meat production. Today, around 2500 farms in Brittany are involved in poultry meat production.

Broilers (55%) and turkeys (35%, decreasing in recent years) are the main types of poultry produced, with also a little place for ducks, Guinea fowls. We must separate export broilers (liveweight at slaughter < 1.6kg, 36 to 44 days depending upon strains), standard broilers (1.6 to 2.1 kg, 40 to 49 days, according to strains) and heavy broilers (>2.1kg, 46 days for females, 53 days for males); 60% of the chicken are for export broilers. Turkeys are for cuts. Less than 5% of the production is under "Label rouge", organic system, or other specified quality.

We can underline the following major traits from figure 1. WTO agreements reduced the CAP subsidies for export, while environmental regulations became effective in EU, weakening poultry chain in Brittany. Accordingly, a long time ago the main local and also European firm in the chain, Doux Company decided to settle also in Brazil. Due to the very hard competition on the markets, domestic as well as international, prices became insufficient to provide a good income for most poultry farmers in Brittany, over the last ten years. Simultaneously they had to cope with new regulations, and to deal with some misunderstanding from the citizens at local and European scales. Among the results, due to low profitability, poultry farmers could not invest to improve their bird sheds, which are progressively becoming obsolete, jeopardizing the technical performances; consequently, poultry farmers' renewal is drastically low. So, the present situation can be stressed as follows; poultry production in Brittany has decreased: - 25% t. carcass weight since 2000, several industrial plants have been closed, farmers and their facilities are ageing, the total area of poultry sheds has decreased by 32% since 2000, (Data from Agreste, French statistical service, 2010), and the image of the overall chain is not attractive. However simultaneously environmental impacts are less worrying, many firms, cooperative as well as private, are merging and resizing. A new structure of the chain is in run, while many actors try to provide the market with new products: "welfare broilers", cuts and processed or convenience foods... Very acute technical skills in the whole chain, technical and economical management capacities, and a regional administrative and sanitary context remain very good assets for the future of the system even though its configuration is not yet known.

*Figure 1: DPSIR for Brittany*



### 3.2. Rio Verde

Rio Verde, in Goiás, Central West of Brazil, appears as a recent territory for agrobusiness. In the middle of 20th century, it was a region of cerrados, with some extensive bovine production, but this situation changed deeply when the Brazilian government decided to develop its western territories. So, the municipe of Rio Verde became an agricultural frontier, with migrating farmers coming notably from the southern states of Brazil, such as Santa Catarina (SC). Within a few years, the territory became a good agricultural region, with a very high production of grains, specially corn and soybean. The population of the municipe is 160000 people, among them about 10% living in rural areas. The main crops over the municipe are soybean (235000 ha, 733000 t, 2d in the state of Goiás), corn (85000 ha, 480000 t, 3rd in the state), cotton, sorghum, beans, rice, sunflower... Sugar cane has expanded strongly since 2005, the area was 6700 ha in 2006, with a very stiff rate of increase (all data from IBGE, 2009). Obviously, public policy was of great influence over these changes and the first steps of the territory development, creating infrastructures as roads, electricity, communication networks.

In this context, Perdigao decided to establish in Rio Verde in 1997, and to build a poultry production chain with a concept of vertical integration. At that time Perdigao was a business company specialized in poultry meat production, previously settled in SC; the increase of domestic demand, specially in big Brazilian towns, and secondly of international market, led the company to take place at Rio Verde, where the feed costs would be very competitive, the farmers, frequently originated from SC, not different from those Perdigao was accustomed to work with. A big complex with poultry slaughterhouse, cutting plant and production of processed and convenience foods started to work in 1999; its capacity is now 440000 broilers / day, or 2640000 / week. It was the heart of the Buriti project, which also strongly benefited by public policy, particularly for low loan rates: 5 to 8% / year for industrial plants as well as farm buildings; at the same moment, the current rates in Brazil were at least 5 times higher.

Perdigao brought into Rio Verde a new poultry chain organization, quite different from its previous one in the South of Brazil; the poultry farms have 4 sheds of 25000 broilers in each. Perdigao provides the farmers feeds and birds, is in charge of their transport, and supplies

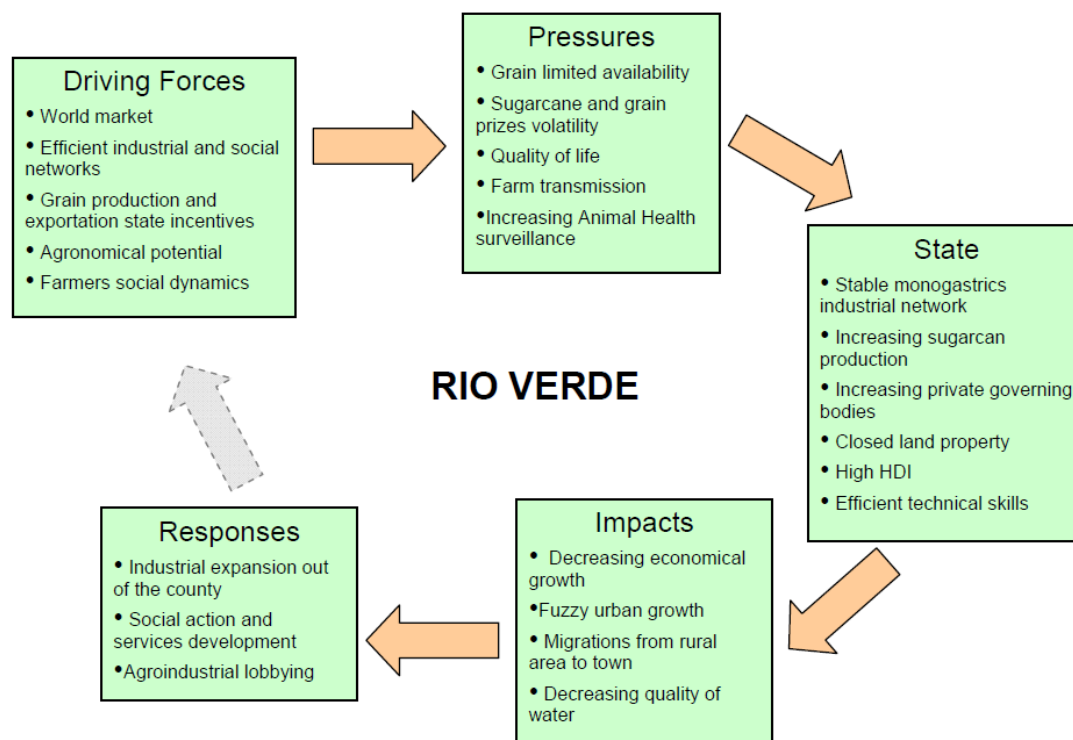


technical advice. Integrated farmers are responsible for following the guidelines of the company, and to breed the broilers up to slaughter weight.

148 poultry producers are involved in the chain; their farms are from 48 to 1030 ha, the mean being 238, and located from within a radius of 50 km from the slaughterhouse. The partnership with the integrator is ruled under a contract renewable each 12 years. Generally, farmers have other productions, such as livestock or crops; it is common for them not to live over the farm, the care for chicken being taken by employees. The industrial complex of Perdigao, which has also developed a large swine production and organized a pork chain, employs directly 8000 people, and provides indirectly over 30000. It includes the poultry and the pork slaughterhouses and plants, the feed mill (1 million t / year), a hatchery, a breeder farm... The poultry types are chesters (4 kg, 56 days), grillers (females, 1.5 kg, 33 days), and males (2.6 kg, 43 days); 97% of the whole production are exported towards 117 countries.

As Perdigao, other big business companies established branches in Rio Verde territory: Cargill, Pionneer, John Deere, Monsanto, Agricola...and there is also a dairy plant and a bovine slaughterhouse: Margem, which exports 10% of its products out of Brazil. So, a dynamic agro industrial cluster took birth over the territory. COMIGO, the most important cooperative of Goias, is located at Rio Verde; its activities are related to grain crops, and it organizes each year the Agrishow, an agricultural technology fair impacting over the state. Farmers composed some kind of rural elite, while the town of Rio Verde provided good social services for health, education... To put all in a nutshell, the development at Rio Verde entered into a virtuous circle. But, it appears now that this way is reaching some limits that we can try to outline.

*Figure 2: DPSIR for Rio Verde*



There is no more potential to increase the production of grains; there no more possibility to enlarge the agricultural land over the territory. It is possible that, in a few years as in other regions in Brazil, sugar cane expansion in view to produce alcohol competes with soybean and corn, due to the limited relevant land areas. Numerous farmers are businessmen



deciding their crops according to prices and markets demands. So a question is to understand what will be the decision of poultry farmers in the future, when their sheds will be paid; they should prefer sugar cane cultivation more than grain production, and they should leave poultry production. In the same time, the global context over the territory is changing. The recent migrants are of origins different from the earlier ones, and shanty buildings appeared in Rio Verde suburbs. Environmental drawbacks are stressed now: water pollution, negative impacts related to massive use of pesticides and herbicides, and questions about GMO crops... Probably, it could be the beginning of a new period, closer to maturity than childhood.

### **3.3. Two Stand Points**

From these two cases, we can draw that to analyse and discuss the sustainability of a "poultry production chain \* territory" system leads to look simultaneously at two aspects, two faces of the same coin:

- . a dynamic aspect, because of the severe competition over the poultry meat markets, the speed of changes within the chain, and the help provided by time for understanding and description of the connections between the two terms of the system
- . a spatial aspect, because many characteristics of the system are linked to the localization of farms or plants, several economical, social and environmental impacts are related at least partially to distances or densities. It is necessary to keep in mind that all the links in the chain can be not inside the territory, it may be the case for governing bodies or dominant actors of the chain; moreover the bonds between the considered territory and other ones or regions cannot be forgotten for feed resources, for poultry meat markets, and also for other locations of several major actors.

As a global result, we concluded that we need to begin with two series of indicators in order to have a likely evaluation of the potential sustainable development of the defined system: one focused on the territory, the other focused on the chain.

## **4. CONDITIONS FOR SUSTAINABILITY**

We look below how and why "poultry production chain \* territory" systems have taken place, grown and, if relevant, decreased over the two regions discussed above. The studied systems dynamics could be considered as the same as a "marketed product" with a (limited over time) life trajectory. We can stress some common factors, or some differences impacting the systems' dynamics, keeping in mind that sustainability is directly connected to systems changes, according to a moving multidimensional environment.

Industrial groups have had a key role over the two territories; there is no possibility to understand the development of poultry production chains without a clear and acute analysis of their decisions and strategies. They are private or cooperative in Brittany, private at Rio Verde, however this point makes nearly no difference between the technical characteristics of the chains over the territory. We find common major characteristics. The main functions are separated, as in an industrial approach closed to taylorism: compound feeds are produced in feed mills, one-day old chicken are provided by hatcheries from hatching eggs of specialized poultry strains, batches of broilers are bred in uniform poultry sheds under standardized technical rules, and the birds are slaughtered in industrial abattoirs. To summarize, physical and technical fluxes are organized similarly in both territories, therefore impacting the land use organization for the poultry concerned issues at least. Moreover, poultry farmers work under contracts which link them to an industrial actor. From a theoretical standpoint, these contracts are usually short term ones (one or a limited number of years long), but in Rio Verde, the initial contracts between Perdigao and the farmers are for 12 years. Nevertheless, they are supposed to ensure the farmers a relevant income and the possibility to pay his loans required for the facilities investments, and this point could be a condition for sustainability of the whole system. However, the relative short term contractualization weakens the farmers' position, and the relation of strength between actors

could be considered in favour of the industrial groups, leading to the major role of the firms over the “poultry chain \* territory” system. Nevertheless, this visual leading of the firms should be mitigated by the expertise and the facilities owned and driven by the farmers, which is a compulsory condition for the chain’s sustainability. To conclude, the contract could be considered as a real two-sided agreement. Obviously, the firms have large and various impacts over the territory. They decide the location of their industrial plants, and consequently of related jobs, they offer the farmers new possibilities of development and diversification, they bring new technologies and innovation process... Finally, they can be among the major actors for the territory development.

Nevertheless, poultry chain is only one part of the activity over the territory. As it grows, other agricultural sectors can follow the same or similar dynamics of development, within the same time frame or delayed, leading to evolving interactions and interconnections between production chains. It was typically the case in Brittany, during the second part of the 20th century: at the same time when the poultry production developed rapidly, other animal production grew also impressively: eggs, beef and veal, milk and pork; it was the case also for vegetables productions. The results were contrasted. Positive impacts were observed as an example on the land use and employment for a first period of development, when economical efficiency was connected with the large size of the built plants and transport network. Negative amenities were also observed on a second period: environmental impacts of a very intensive agriculture mentioned above, showing us the need of a global regulation at the territory level. This example may be useful for the case of Rio Verde, since the poultry production is still increasing and other productions as pigs and bovine too. A difference with Brittany may be that the sugarcane industry is not really connected with the other agricultural sectors: in Brittany, strength was the more or less coordinated links between productions, while in Rio Verde sustainability of the “poultry chain \* territory” system could be questioned if a formal agreement with the sugarcane industry is not found.

We may also remind the links between territories. For Brittany, a major part of grains and the totality of soybean necessary for animal production, and specifically poultry, are imported from other territories, such as Brazil for soybean. Rio Verde is completely different, since it produces cheap maize and soybean, even though it is always possible to get cheaper feedstuffs by moving norther. Several consequences need to be taken into account: it will be very useful to have life cycle assessments for the whole chain including this international transport of feeds, a question related to the old question of protein crops production in Europe. But it is simultaneously compulsory to look how to reach the compliance with the local regulations for environment. Brittany, and more broadly the EU, can be seen as a precursor in this area: to sustain usable producing lands, local regulation have to be achieved and applied. The main actors within the chains can propose industrial processes for the treatment of animal manure, in view to obtain organic fertilizers which can be sold outside the territory, or used as energy sources... Such solutions are examples of industrial referents, speaking as Godard cited above.

We can point out the importance of the “technical packages” brought by the leading actor in the chain. Its major components are: a specialized strain of broilers, a compound balanced diet, a standardized poultry shed, a precise breeding protocol with technical and sanitary rules, the farmer has to comply with under the subscribed contract. In the two cases, the “technical package” was mainly imported: historically, the model created in the United States spread over the world with modern aviculture, with only limited local adaptations. In Brittany, the model was clearly derived from that in USA, and adapted to small farms; at Rio Verde, it was brought by Perdigao from its previous counties in the Southern part of Brazil, and adapted to the local context, mainly the climate and the locally available feedstuffs. This compulsory use of technical packages, which is an advantage as far as one goal is followed, here low-cost production, can be a dangerous tool if sustainability becomes the key issue. Using standardized procedures limits strictly the system adaptability, through the lack of technical degrees of freedom. Therefore, this should lead to low innovation level. Two examples could be given: broiler strains more locally adapted could be obtained to react more efficiently to heat issues, however they will be less economically efficient on a short

time scale; local feedstuffs could be used to avoid some transportation, however, this will enhance performance variability, which seems to be nowadays a *cassus belli* in the poultry chain. So a key point to deal is obviously the contractualization within the poultry chain, which could have negative impacts on the innovation process, therefore weakening the overall system sustainability at a given time of his trajectory.

In the two cases, farmers and rural population over the territory were ready to be involved in the development of the system. In Brittany, in the 60's, numerous families living over too small farms were seeking for new incomes; poultry production was a relevant mean for this objective, as it could be an "off-land" production therefore possible without additional land use. Simultaneously, many people in the rural population were available, and interested by industrial jobs near to the farms; they gave adequate and dedicated labour for the new rural plants over the territory, such as feed mills, hatcheries, slaughterhouses... At Rio Verde, we mentioned above how the migrating farmers needed outlets for their increasing grains and soybean production; they previously knew Perdigao company, while at least some of them had before heard about poultry production or already been poultry producers. Other migrating people were just asking for jobs. However, available and willing manpower both for farms and plants is not a stable issue. Due to increasing educational level, to town appeal ant to a relative negative perception of poultry farm work, large difficulties are encountered in Brittany, and this could be also the case in Rio Verde in a few years, to ensure a sufficient turnover of the poultry farms, leading to a decreasing production level. Sustainability of the "poultry chain \* territory" system should take very early into account professional education to ensure qualified and motivated farmers and employees.

In the two regions, it is possible to underline the role of public policy. It is very clear at Rio Verde, as explained above: the territory has become an agricultural area after the decision of developing its western territories by the Brazilian government. But public policies can also be pinpointed in the case of Brittany. During several decades the European Common Agricultural Policy (CAP) created favourable conditions for the development of poultry production, notably by protecting the domestic market with a common customs tariff and by helping to reach international markets with exports subsidies. At the same period, the general infrastructures in the region greatly bettered: roads, trains, ports, telecommunications... while the general level of education was strongly enhanced and the public research capacities too. But public policies change along the time. Of very great importance for what we discuss here is the creation of the World Trade Organization (WTO), in 1995. The consequences were quasi opposite for the two "poultry production chain \* territory" systems. The agreement improved the exporting capacities and stimulated the general dynamics at Rio Verde, whereas it led to severe difficulties in Brittany, due to new competitors on the domestic European market, and a loss of competitiveness on the international market after the reduction of CAP export subsidies, the CAP having been revised to comply with the new international commercial agreement. This provides a good example to show that sustainability has to be considered in a given political and administrative framework.

Naturally, we must underline other aspects of the course of time. We have mentioned above how the times reveals some environmental impacts related to increasing livestock densities and long run cumulative effects. In the same time, and probably partially linked, the standpoint of the society living over the territory changes too, and it is also part of the conditions of sustainability of the system we are discussing about: what is hoped at one at one period can be not accepted later.

## CONCLUSION

Poultry industry is seldom considered when thinking about sustainability. We have given several reasons for that. Nevertheless, the two cases analysed in this paper show that it could be an interesting matter for discussing this global issue. It appears that poultry production gives an original way to better understand how and why the links between an economic sector and a territory could allow a more sustainable development.

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